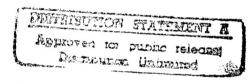


PROGRAMMING AND IMPLEMENTATION DOCUMENTATION

FEASIBILITY STUDY FOR INSTALLATION OF UMCS FORT RILEY, KANSAS

ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

Prepared for



U.S. ARMY CORPS OF ENGINEERS KANSAS CITY DISTRICT KANSAS CITY, MISSOURI

DING QUADEF ENSELUTED 2

Under

U.S. ARMY ENGINEER DISTRICT, MOBILE INDEFINITE DELIVERY A-E CONTRACT CONTRACT NO. DACA01-94-D-0033 DELIVERY ORDER NO. 0001



DENVER, COLORADO ATLANTA, GEORGIA

DEPARTMENT OF THE ARMY

CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS P.O. BOX 9005 CHAMPAIGN, ILLINOIS 61826-9005

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Marie Wakeffeld, Librarian Engineering

PROGRAMMING AND IMPLEMENTATION DOCUMENTATION

FEASIBILITY STUDY FOR INSTALLATION OF UMCS FORT RILEY, KANSAS

ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

Prepared for

U.S. Army Corps of Engineers Kansas City District Kansas City, Missouri

Under

U.S. Army Engineer District, Mobile Indefinite Delivery A-E Contract Contract No. DACA01-94-D-0033 Delivery Order 0001 EMC No. 1406-001

December 1995

By

E M C Engineers, Inc. 2750 S. Wadsworth, Suite C-200 Denver, Colorado 80227 303/988-2951

1. COMPONENT ARMY	FY 1995 MILITARY CO	ONSTRUC	CTION PROJECT	DATA	2. DATE DEC 1995
3. INSTALLATION AND LOCATION Fort Riley, Kansas				sewide Utility M ystem (UMCS)	onitoring
5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJEC	T NO.	8. PROJECT COS 5,8	
	9. COST ES	TIMATES			
Г	TEM	U/M	QUANTITY	UNIT COST	COST (\$000)
Provide PC-based Central Operator S Processor, Remote Control Units, Units sensors, and actua	o include 190 buildings. front-end computers, Station, Communication e Control Units, Auxiliary ary Control Units, ators. Provide fiber optic to the 190 buildings on	LS			4,698
Estimated Contract Co	ost				4,698
Contingency (10%)					470
Subtotal					5,168
Supervision, Inspection Design Cost (6.0%)	n and Overhead (7.0%)				362 310
TOTAL REQUEST TOTAL REQUEST (R	OUNDED)				5,840 5,840

10. DESCRIPTION OF PROPOSED CONSTRUCTION

Construct a Utility Monitoring and Control System (UMCS) to monitor and control HVAC systems, and the utilities serving 190 buildings at Fort Riley. The UMCS will replace the existing HVAC control systems and energy monitoring and control system (EMCS). The UMCS would consist of PC-based front-end computers communicating to building control units. Other associated items include software, fiber optic data communication systems, instrumentation, documentation, training, and testing of equipment.

11. REQUIREMENT

This project is required to correct local HVAC control problems and deficiencies, in order that environmental cooling and heating are adequately provided for active duty personnel at Fort Riley. This project will replace the existing local loop HVAC controls system with a new UMCS. The UMCS will monitor and control the facilities' HVAC systems, and utilities. This project will reduce the natural gas consumption, electrical consumption, and electric demand of HVAC systems through UMCS control technology. An immediate utility savings would be recognized.

1. COMPONENT ARMY	FY 1995 MILITARY CONSTRUCTION PROJ	ECT DATA	2. DATE DEC 1995
3. INSTALLATION AND LC Fort Riley, Kansas			
4. PROJECT TITLE Install Basewide l	Utility Monitoring Control System (UMCS)	5. PROJECT	NUMBER

11. REQUIREMENT (continued)

The project will include the following items of work:

- The UMCS will include PC-based front-end computers communicating to building Control Units, to control and monitor HVAC systems.
- Existing automatic temperature control equipment will be removed and disposed of. Some end control device components will be reused in the new UMCS and will be checked and commissioned into operating condition.
- New Direct Digital Control (DDC) components will be installed, to provide the required sequences of operation, input/output functions, and monitoring functions, including necessary software, hardware, instrumentation, communications, training, and documentation.
- The field hardware in the 23 buildings on the existing EMCS will be replaced.

Modifications or repairs to the existing mechanical and electrical equipment would be provided to assure a complete, well operating control system.

Additionally, the project will result in a more functionally efficient system providing greater reliability and more accurate temperature control, and will yield significant savings in operating costs by a more accurate and precise operation of air handling units, boilers, chillers, and other equipment.

Current Situation:

Fort Riley has an existing EMCS connected to 23 buildings. The EMCS was installed in 1985. The EMCS has a central operator station that includes a TI 112 CPU with a 40 megabyte hard drive, a cartridge tape data storage, a color monitor, a TI terminal printer, two dot matrix printers, and telephone modems. The EMCS has three work stations each consisting of a monitor, a telephone modem, and a dot matrix printer located at three remote sites from the central operator station.

Discussions with the EMCS operators at Fort Riley regarding the existing EMCS indicated the system is currently used to its capacity, is energy inefficient, and is technologically obsolete (failing).

1. COMPONENT ARMY	FY 1995 MILITARY CONSTRUCTION PRO	JECT DATA	2. DATE DEC 1995
3. INSTALLATION AND LO Fort Riley, Kansas			
4. PROJECT TITLE Install Basewide (Jtility Monitoring Control System (UMCS)	5. PROJECT	NUMBER

11. REQUIREMENT (continued)

Impact if Not Provided:

If this project is not funded, a reduction of 211,470 MBtu/yr (223,100,850 MJ/yr) cannot be achieved. The Army will not realize a \$1,525,870 annual energy dollar savings with a 3.95 simple payback and a savings-to-investment ratio (SIR) of 2.3. Excessive amounts of natural gas and electricity will continue to be used, and there will be no contribution to energy reduction goals established for U.S. Army facilities by Army Headquarters.

Supporting Documentation:

Supporting data includes basic engineering calculations which show energy savings. The supporting data was documented and conducted under an Army contract performed by an A-E firm (E M C Engineers, Inc.) in FY 95.

Verification of Savings:

The Fort Riley Army facility uses existing electrical meters and natural gas meters which are read monthly by the local utility companies. Historic monthly electrical and natural gas use data are available and can be obtained for monthly billing periods. The energy use for billing periods prior to the installation of the UMCS can be compared to the energy use for billing periods subsequent to the UMCS installation.

Amount of Energy Conserved:

The amount of energy conserved is estimated to be 211,470 MBtu per year (223,100,850 MJ/yr).

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

			EN	ERGY CONSERV	ATION INVESTMEN	IT PROGRAM (ECIP)		
		LOCATION:	Fort Riley		REGION: 2 (Kansas))	PROJECT NO:	1406-005
		PROJECT TITLE:	Feasibility Stu	dy for Installatio	n of UMCS		FISCAL YEAR:	1995
		ANALYSIS DATE:	12/13/95		ECONOMIC LIFE:	10	PREPARED BY:	A. Niemeyer
								,
1.	INV	ESTMENT: Install Base	wide UMCS wit	h DDC Controls				
	A.	CONSTRUCTION COST		=			\$5,167,395	
	В.	SIOH COST	C	7.0% of 1A) =			\$361,718	
	C.	DESIGN COST	(6	6.0% of 1A) =			\$310,044	
	D.	TOTAL COST	(1A	+1B +1C) =			\$5,839,156	
	E.	SALVAGE VALUE OF EX	XISTING EQUIP	MENT =			\$0	
	F.	PUBLIC UTILITY COMPA	ANY REBATE =				\$0	
	G.	TOTAL INVESTMENT		(1D -1E -1F) =			>	\$5,839,156
2.	ENE	RGY SAVINGS (+) OR C	OST (-):					
	DAT	E OF NISTR 85-3273-9	USED FOR DISC	OUNT FACTOR	S:	JAN '95		
		ENERGY	FUEL COST	SAVINGS	ANNUAL \$	DISCOUNT	DISCOUNTED	i
		SOURCE	\$/MBTU (1)	MBTU/YR (2)	SAVINGS (3)	FACTOR (4)	SAVINGS (5)	l
	Α.	ELECT.	\$12.10	58,176	\$703,926	8.78	\$6,180,473	
	В.	DIST	\$0.00	0	\$0	9.88	\$0	
	C.	NAT GAS	\$4.12	153,296	\$631,580	9.53	\$6,018,953	
	D.	COAL	\$0.00	0	\$0	8.95	\$O	
	E.	ELEC. DEMAND			\$190,361	8.53	\$1,623,780	
	F.	TOTAL		211,472	\$1,525,867		>	\$13,823,206
3.	NON	-ENERGY SAVINGS (+)	OR COST (-)					
	Α.	ANNUAL RECURRING (-						
		1 ANNUAL MAINTENA			(\$116,206)	8.53	(\$991,237)	
		2 ANNUAL MANHOUR	SAVINGS		\$67,824	8.53	\$578,539	
		3				8.53	\$0	0,1
		4 TOTAL ANNUAL DISC	C. SAVINGS (+) / COST (-)	(\$48,382)		(\$412,698)	
	В.	NON-RECURRING (+/-)						
		ITEM		SAVINGS (+)	YEAR OF	DISCOUNT	DISCOUNTED	
			(COST(-) (1)	OCCURRENCE (2)			
					(2)	(TABLE A-2)		
		a.		\$0	1	0.971	\$0	
		b.			·	,	\$0	
		c.					\$0	ļ
		d.					\$0	
		e.					\$0	
		f. TOTAL		\$ 0			\$0	
	C.	TOTAL NON-ENERGY D	ISCOUNTED SA	VINGS (+) OR	COST (-)	(3A4 + 3Bf4) =		(\$412,698)
4.	FIRS	T YEAR DOLLAR SAVING	SS (+) / COSTS	(-)		(2F3 + 3A4 + (3Bf1/Eco	nomic Life))	\$1,477,485
5.	SIMI	PLE PAYBACK (SPB) IN Y	EARS (MUST BI	< 10 YEARS	TO QUALIFY)	(1G/4) =		3.95
6.	тот	AL NET DISCOUNTED SA	VINGS			(2F5 + 3C) =		\$13,410,508
7.	DISC	COUNTED SAVINGS-TO-II	NVESTMENT RA	TIO (SIR)		(6/1G) =		2.30
L		(MUST HAVE SIR > 1.2	5 TO QUALIFY					

	ENGINEER'S OPINION OF PROBABLE COST	ON OF PROBAB	CE CO	ST	,				SHEET	-		P.	10
AREA	1	ACTIVITY				LOCATION Et Bilay Kaneae				AMENDMENT NO.	NO.		1
000	DEN IECT TITI E						CONTRACT NO						
EEAP,	EEAP, Feasibility Study for Installation of UMCS	UMCS								DACA01-94-D-0033	0033		
					MATERIAL COST	AL COST		LABOR COST		EQUIPME	EQUIPMENT COST	TOTAL COST	COST
			Unit	Š.				Manhrs					
Line	Item Description	ption	of	ō	Onit		Unit	ъе		Chrit		Unit	
No.			Meas.	Units	Cost	Total	Cost	Unit	Total	Cost	Total	Cost	Total
-	INSTALLATION OF UMCS												
7	UMCS SOFTWARE/DATABASE		ST	1		0\$			\$144,580		\$0		\$144,580
က	UMCS CENTRAL EQUIPMENT		ST	1		\$99,180			\$9,828		%		\$109,008
4	TRAINING		ST	-		\$0			\$73,110		0\$		\$73,110
5	DOCUMENTATION AND SUBMITTALS	ITTALS	ST	-		0\$			\$50,000		0\$		\$50,000
9	TESTING		ST	-		\$0			\$197,908		\$0		\$197,908
7	TOTAL FIELD HARDWARE		รา	1		\$1,452,577			\$968,385		0\$		\$2,420,962
∞	FIBER OPTIC DTM		ST	-		\$326,908			\$217,939		O \$		\$544,847
6	ACM REMOVAL		ST	-		\$2,708			\$11,501		\$1,359		\$15,567
9	RF SYSTEM FOR REMOTE SITE MONITORING	TE MONITORING	ST	-		\$36,500			\$13,119		\$		\$49,619
=	FO DTM & EQUIP FOR UTILITY MONITORING	MONITORING	LS	-		\$7,942			\$9,426		\$0		\$17,368
12	SALES TAX		%	0.0		0\$							0\$
13	CONSTRUCTION SUBTOTAL	JBTOTAL				\$1,925,815			\$1,695,795		\$1,359		\$3,622,969
14	OVERHEAD		%	15.0		\$288,872			\$254,369		\$204		\$543,445
15		SUBTOTAL				\$2,214,688			\$1,950,164		\$1,562		\$4,166,414
16	BOND		%	2.5		\$55,367			\$48,754		\$39		\$104,160
17		SUBTOTAL				\$2,270,055			\$1,998,918		\$1,601		\$4,270,574
18	PROFIT		%	10.0		\$227,005			\$199,892		\$160		\$427,057
19		SUBTOTAL				\$2,497,060			\$2,198,810		\$1,761		\$4,697,632
20	CONTINGENCY		%	10.0		\$249,706			\$219,881		\$176		\$469,763
21	GRAND TOTAL					\$2,746,766			\$2,418,691		\$1,938		\$5,167,395
22	SIOH COST		%	7.0									\$361,718
23	DESIGN COST		%	0.9									\$310,044
24	CURRENT WORKING ESTIMATE	TE											\$5,839,156
52													
56	1ST YR MAINT COST (8% of Field Hardwr Mat. Cost)	ield Hardwr Mat. Cost)	%	8.0		\$116,206			0\$		0\$		\$116,206
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Line	Item Description	ption	jo	ф	Unit		Unit	per		Onit		Cuit	
Š.			Meas.	Units	Cost	Total	Cost	- Cuit	Total	Cost	Total	i de	Total
-	ALTERNATIVE NO. 1											1000	100
2	UMCS SOFTWARE	WARE											
က	OPERATING SYSTEM		ST	0	\$0.00	\$0	\$0.00	0.0	\$0	\$0.00	0\$	00.05	0\$
4	APPLICATION SOFTWARE		ST	0	\$0.00	\$0	\$0.00	0.0	9	00.0\$	0\$	\$0.00	9
2	COMMAND SOFTWARE		ST	0	\$0.00	\$0	\$0.00	0.0	\$0	\$0.00	C S	00.08	0\$
9	LUMP SUM TOTAL	OTAL			\$16,800.00	\$0	\$0.00	00	0\$	000	05	646 900 00	9
7								3	3	9.0	O.	00.000,01¢	O#
80	UMCS DATABASE	BASE											
6	DATABASE GENERATION		PTS	6,680	\$0.00	\$0	\$24.00	0.8	\$120.240	\$0.00	Ş	418.00	6120 240
9	GRAPHIC DISPLAY GENERATION	NO	DIAG	42	\$0.00	\$0	\$24.00	5.0	\$5,040	\$0.00	9	\$120.00	\$5,040
=	GRAPHIC DISPLAY DUPLICATION	NO	EA	965	\$0.00	\$	\$24.00	0.8	\$19.300	00.0\$	S	\$20.00	940,040
12								2	000	0.00	0	\$20.00	\$19,300
13													
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56	TOTAL THIS PAGE					0\$			\$144,580		\$0		\$144 580
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Unit Cost Cost \$8,665.00 \$720.00 \$720.00 \$720.00 \$72,244.00 \$12,253.00 \$12,253.00 \$12,253.00 \$12,253.00 \$12,253.00 \$12,253.00 \$12,253.00 \$12,253.00		ENGINEER'S OPINION OF PROBABLE COST	ON OF PROBAB	CE CO	ST					SHEET	3		OF.	10
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UMCS CRITACL EQUIPMENT EA 1 \$8,400.0 \$8.20 1 \$8,665.0 TRAL OPERATORY STATION EA 1 \$720.00 \$720 0.0 \$9.0	-	ALTERNATIVE NO. 1												
This page This	2	UMCS CENTRAL	EQUIPMENT											
Main Figure EA 1 \$72.00 \$1	က	CENTRAL OPERATOR STATIC	NC.	EA	-	\$8,400.00	\$8,400	\$22.00	12	\$265		\$0	\$8,665.00	\$8,665
Color Details Color Detail	4	ALARM PRINTER		EA	-	\$720.00	\$720	\$0.00	0.0	\$0		\$0	\$720.00	\$720
Colore C	5	LOGGING PRINTER (LASER)		EA	+	\$2,244.00	\$2,244	\$0.00	0.0	\$		\$0	\$2,244.00	\$2,244
Color Monor Mono	9	FIBER OPTIC MODEM		EA	22	\$624.00	\$13,728	\$0.00	0.0	\$0		\$0	\$624.00	\$13,728
TABLE TISTS SET	7	TELEPHONE MODEM		EA	1	\$360.00	\$360	\$22.00	4	\$98		\$0	\$457.62	\$458
ALLHIS PAGE LS 1 \$10.00 \$10 \$10.00 \$	80	PORTABLE TEST SET		EA	1	\$1,800.00	\$1,800	\$0.00	0.0	\$		\$0	\$1,800.00	\$1,800
OTE WORKSTATION NO. 1 EA 1 \$11,988.00 <td>6</td> <td>INSTALLATION AND TESTING</td> <td></td> <td>รา</td> <td>-</td> <td>\$0.00</td> <td>0\$</td> <td>\$22.00</td> <td>358</td> <td>\$7,875</td> <td></td> <td>\$0</td> <td>\$7,875.00</td> <td>\$7,875</td>	6	INSTALLATION AND TESTING		รา	-	\$0.00	0\$	\$22.00	358	\$7,875		\$0	\$7,875.00	\$7,875
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OTE WORKSTATION NO. 6 EA 1 \$11,988.00 \$11,988 \$22.00 12 \$265.00 \$0.00 \$0 \$12,253.00 ALTHIS PAGE AJN DEJ 1 \$11,988.00 \$11,988 \$10 \$10 \$10 \$10 \$10 \$10 \$10 \$10 \$10 \$10	15	REMOTE WORKSTATION NO.	5	EA	1	\$11,988.00	\$11,988	\$22.00	12	\$265.00		\$0	\$12,253.00	\$12,253
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AREA		ACTIVITY				LOCATION				AMENDMENT NO.			
						Ft. Riley, Kansas							
ROJE	PROJECT TITLE						CONTRACT NO.						
EAP, F	EEAP, Feasibility Study for Installation of UMCS	of UMCS								DACA01-94-D-0033	0033		
					MATERIAL COST	T COST		LABOR COST		EQUIPMENT COST	INT COST	TOTAL COST	COST
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Line	Item Description	niption	ğ	ō	Unit		Onit	ber		Chrit		Unit	
Š.			Meas.	Onits	Cost	Total	Cost	ij	Total	Cost	Total	Cost	Total
1	ALTERNATIVE NO. 1												
2	TRAINING	NG											
3	OPERATOR TRAINING 1		EA	-	\$0.00	0\$	\$22.00	293	\$6,450.00	\$0.00	0\$	\$6.450.00	\$6.450
4	OPERATOR TRAINING 2		EA	-	\$0.00	0\$	\$22.00	288	\$6,330.00	\$0.00	0\$	\$6,330.00	\$6.330
5	OPERATOR TRAINING 3		EA	1	\$0.00	\$0	\$22.00	755	\$16,610.00	\$0.00	0\$	\$16,610.00	\$16,610
9	OPERATOR TRAINING 4		EA	9	\$0.00	0\$	\$132.00	30	\$23,520.00	\$0.00	\$0	\$3,920.00	\$23,520
~	MAINTENANCE TRAINING		Æ	-	\$0.00	\$0	\$22.00	255	\$5,600.00	\$0.00	\$0	\$5,600.00	\$5,600
20			-										
n (REVIEW SUBMITTALS		S	-	\$0.00	\$0	\$0.00	0	\$14,600.00	\$0.00	\$0	\$0.00	\$14,600
9													
Ξ													
12													
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14													
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20													
21													
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24													
25													
. 92	TOTAL THIS PAGE					\$0			\$73,110		\$0		\$73,110
PREPARED BY	:D BY	APPROVED BY				TITLE OR ORGANIZATION	ATION			DATE			
	N V		2										

	ENGINEER'S OPINION OF PROBABLE COST	ROBABLE CO	JST				S	SHEET	5	PO	L	10
AREA	ACTIVITY				LOCATION				AMENDMENT NO.	NO.		
					Ft. Riley, Kansas							
PROJE(РКОЈЕСТ ТПТЕ					CONTRACT NO.						
EEAP, F	EEAP, Feasibility Study for Installation of UMCS								DACA01-94-D-0033	0033		
				MATER	MATERIAL COST	1	LABOR COST		EQUIPMENT COST	NT COST	TOTAL COST	COST
		Unit	S.				Manhrs					
Line	Item Description	o	ō			Crit	bē.		Cuit		Onit	
No.		Meas.	Units	Cost	Total	Cost	Unit	Total	Cost	Total	Cost	Total
-	ALTERNATIVE NO. 1											
2	DOCUMENTATION AND SUBMITTALS	ALS										
က	DOCUMENTATION	ST		1 \$0.00	0\$	\$75.00	299	\$50,000	\$0.00	\$0	\$50,000.00	\$50,000
4												
5	TESTING											
9	FACTORY TEST	rs		\$0.00	0\$	\$22.00	455	\$10,000	\$0.00	0\$	\$10,000.00	\$10,000
7	PERF. VERIFICATION TEST	rs		1 \$0.00	0\$	\$22.00	545	\$12,000	\$0.00	\$0	\$12,000.00	\$12,000
8	ENDURANCE TEST	rs		1 \$0.00	0\$	\$22.00	455	\$10,000	\$0.00	0\$	\$10,000.00	\$10,000
6	OPPOSITE SEASON TEST	ST		1 \$0.00	0\$	\$22.00	227	\$5,000	\$0.00	0\$	\$5,000.00	\$5,000
10	CONTRACTOR FIELD TEST (DIGITAL)	PNT	2,922	\$0.00	0\$ 0	\$22.00	0.75	\$48,213	\$0.00	\$0	\$16.50	\$48,213
=	CONTRACTOR FIELD TEST (ANALOG)	PNT	6,830	30 \$0.00	0\$ 0	\$22.00	0.75	\$112,695	\$0.00	0\$	\$16.50	\$112,695
12	TOTAL TESTING				\$0			\$197,908				\$197,908
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
52												
56	TOTAL THIS PAGE				0\$			\$247,908		0\$		\$247,908
PREPARED BY	RED BY APPROVED BY	1Y			TITLE OR ORGANIZATION	ZATION			DATE			
	AJN	DEJ				EMCEngineers, Inc.	ers, Inc.			1	12/13/95	
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4 2 4	LINGINGERY OF INTOINE OF THE COOL	PRODADLE OF	2				S	SHEET	9	J	Q.	9
AKEA	ACTIVITY				LOCATION				AMENDMENT NO.	NO.		
					Ft. Riley, Kansas							
PROJECT TITLE	T TITLE				<u>J</u>	CONTRACT NO.						
EEAP, F	EEAP, Feasibility Study for Installation of UMCS							ں	DACA01-94-D-0033	0033		
				MATERIAL COST	AL COST	ľ	LABOR COST		EQUIPMENT COST	NT COST	TOTAL COST	COST
		Unit	No.				Manhrs					
Line	Item Description	o	ţ	Prit C		Onit	ber		Onit		Curit	
Š.		Meas.	Units	Cost	Total	Cost	Onit	Total	Cost	Total	Cost	Total
-	ALTERNATIVE NO. 1											
2	FIELD HARDWARE											
3	FIELD HARDWARE FOR BLDG SYST.	ST	-	\$1,452,577	\$1,452,577	\$22.00	44,017	\$968,385	\$0.00	0\$	\$2,420,962	\$2,420,962
4	(includes cost for field panels)											
2												
9	FIELD HARDWARE SUBTOTAL	ral			\$1,452,577			\$968,385				\$2,420,962
7												
æ	FIBER OPTIC DTM											
6	UNDERGROUND DTM CONDUIT	SJ	-	\$326,908	\$326,908	\$22.00	906'6	\$217,939	\$0.00	\$0	\$544,847.00	\$544,847
9	(134,158 LF)											
F												
12												
13												
14												
15												
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22												
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24												
25												
56	TOTAL THIS PAGE				\$1,779,485			\$1,186,324		0\$		\$2,965,809
PREPARED BY					TITLE OR ORGANIZATION	ATION			DATE			
	AJN	DEJ				E M C Engineers, Inc.	ers, Inc.				12/13/95	

	ENGINEER'S OPINION OF PROBABLE COST	ON OF PROBABI	LE COS	ĭ				S	SHEET	7		OF	9
AREA		ACTIVITY				LOCATION		-		AMENDMENT NO.	NO.		
						Ft. Riley, Kansas							
PROJE	PROJECT TITLE	IMCO					CONTRACT NO.		_	DACA01.94.D.0033	7033		
	reasibility study for illistaliation of	2000			AIGHTAN	1000		* DOD 000T		-0-16-10000	1000	1101	100
			2		MATERIAL COST	L COS I		LABOR COST		EQUIPMENT COST	ISOS IN	IOIALCOSI	ison
<u>=</u>	Item Description	noijo.	ğ 'e		Ē	•	Init	Mannrs		in in		ţ	
g S			Meas.	Units	Cost	Total	Cost	e it	Total	Cost	Total	Cost	Total
-	ALTERNATIVE NO. 1												
2	ACM REMOVAL - GLOVEBAG METHOD	METHOD											
က	BUILDING 222		EA	5	\$12.00	\$60	\$32.00	1.6	\$256	\$6.50	\$33	\$69.70	\$349
4	BUILDING 610		EA	2	\$12.00	\$60	\$32.00	1.6	\$256	\$6.50	\$33	\$69.70	\$349
5	BUILDING 723		EA	7	\$12.00	\$84	\$32.00	1.6	\$358	\$6.50	\$46	\$69.70	\$488
9	BUILDING 5000		Ę	4	\$12.00	\$48	\$32.00	1.6	\$205	\$6.50	\$26	\$69.70	\$279
7	BUILDING 5315		EA	7	\$12.00	\$84	\$32.00	1.6	\$328	\$6.50	\$46	\$69.70	\$488
80	BUILDING 7024		EA	8	\$12.00	96\$	\$32.00	1.6	\$410	\$6.50	\$52	\$69.70	\$558
6	BUILDING 7033		EA	3	\$12.00	\$36	\$32.00	1.6	\$154	\$6.50	\$20	\$69.70	\$209
9	BUILDING 7050		EA	2	\$12.00	\$24	\$32.00	1.6	\$102	\$6.50	\$13	\$69.70	\$139
=	BUILDING 7086		EA	3	\$12.00	\$36	\$32.00	1.6	\$154	\$6.50	\$20	\$69.70	\$209
12	BUILDING 7243		EA	2	\$12.00	\$24	\$32.00	1.6	\$102	\$6.50	\$13	\$69.70	\$139
13	BUILDING 7285		EA	4	\$12.00	\$48	\$32.00	1.6	\$205	\$6.50	\$26	\$69.70	\$279
14	BUILDING 7602 (did not qualify)		EA	0	\$12.00	0\$	\$32.00	1.6	\$0	\$6.50	\$0	\$69.70	\$0
15	BUILDING 7606		EA	9	\$12.00	\$72	\$32.00	1.6	\$307	\$6.50	\$39	02'69\$	\$418
16	BUILDING 7608 (did not qualify))	EA	0	\$12.00	0\$	\$32.00	1.6	\$0	\$6.50	\$	\$69.70	\$0
17	BUILDING 7612		EA	8	\$12.00	96\$	\$32.00	1.6	\$410	\$6.50	\$52	\$69.70	\$558
18	BUILDING 7614		EA	8	\$12.00	96\$	\$32.00	1.6	\$410	\$6.50	\$52	\$69.70	\$558
19	BUILDING 7616		EA	8	\$12.00	96\$	\$32.00	1.6	\$410	\$6.50	\$52	\$69.70	\$558
20	BUILDING 7618		EA	3	\$12.00	\$36	\$32.00	1.6	\$154	\$6.50	\$20	\$69.70	\$209
21	BUILDING 7620		EA	3	\$12.00	\$36	\$32.00	1.6	\$154	\$6.50	\$20	\$69.70	\$209
22	BUILDING 7622		EA	2	\$12.00	\$60	\$32.00	1.6	\$256	\$6.50	\$33	\$69.70	\$349
23	BUILDING 7626		Æ	3	\$12.00	\$36	\$32.00	1.6	\$154	\$6.50	\$20	\$69.70	\$209
24	BUILDING 7630		EA	က	\$12.00	\$36	\$32.00	1.6	\$154	\$6.50	\$20	\$69.70	\$209
22	BUILDING 7636		EA	4	\$12.00	\$48	\$32.00	1.6	\$205	\$6.50	\$26	\$69.70	\$279
56	TOTAL THIS PAGE					\$1,212			\$5,171		\$657		\$7,040
PREPA	PREPARED BY	APPROVED BY				TITLE OR ORGANIZATION	ATION			DATE			
	AJN		DEJ				E M C Engineers, Inc.	ers, Inc.				12/13/95	

	ENGINEER'S OPINION OF PROBABLE COST	IION OF PROBAE	SLE CO	ST					SHEFT	α		2	ç
AREA		ACTIVITY				LOCATION				AMENDMENT NO.		5	2
						Ft. Riley, Kansas							
PROJE	PROJECT TITLE						CONTRACT NO.						
EEAP,	EEAP, Feasibility Study for Installation of UMCS	of UMCS								DACA01-94-D-0033	-0033		
					MATERIAL COST	T COST		LABOR COST		EQUIPME	EQUIPMENT COST	TOTAL COST	COST
_:	:	;	ij.	è.				Manhrs					
CIPE	Item Description	cription	5	jo	Cuit		Ouit	ber		Onit		Unit	
S S			Meas.	Units	Cost	Total	Cost	Unit	Total	Cost	Total	Cost	Total
-	ALTERNATIVE NO. 1												
2	ACM REMOVAL - GLOVEBAG METHOD (cont'	G METHOD (cont')											
3	BUILDING 7642		EA	3	\$12.00	\$36	\$32.00	1.6	\$154	\$6.50	\$20	\$69.70	\$209
4	BUILDING 7644		EA	3	\$12.00	\$36	\$32.00	1.6	\$154	\$6.50	\$20	\$69.70	\$209
2	BUILDING 7648		EA	5	\$12.00	\$60	\$32.00	1.6	\$256	\$6.50	\$33	\$69.70	\$349
9	BUILDING 7652 (did not qualify)	(A)	E	0	\$12.00	\$0	\$32.00	1.6	\$0	\$6.50	0\$	\$69.70	\$0
7	BUILDING 7654		E	4	\$12.00	\$48	\$32.00	1.6	\$205	\$6.50	\$26	\$69.70	\$279
∞	BUILDING 7658		Æ	9	\$12.00	\$72	\$32.00	1.6	\$307	\$6.50	\$39	\$69.70	\$418
6	BUILDING 7739		EA	4	\$12.00	\$48	\$32.00	1.6	\$205	\$6.50	\$26	\$69.70	\$279
9	BUILDING 7804		EA	7	\$12.00	\$84	\$32.00	1.6	\$358	\$6.50	\$46	\$69.70	\$488
=	BUILDING 7810		E	∞	\$12.00	96\$	\$32.00	1.6	\$410	\$6.50	\$52	\$69.70	\$558
12	BUILDING 7812		E	80	\$12.00	96\$	\$32.00	1.6	\$410	\$6.50	\$52	\$69.70	\$558
13	BUILDING 7816		EA	80	\$12.00	96\$	\$32.00	1.6	\$410	\$6.50	\$52	\$69.70	\$558
4	BUILDING 7820		EA	3	\$12.00	\$36	\$32.00	1.6	\$154	\$6.50	\$20	\$69.70	\$209
15	BUILDING 7826		E	က	\$12.00	\$36	\$32.00	1.6	\$154	\$6.50	\$20	\$69.70	\$209
9	BUILDING 7842		E	8	\$12.00	96\$	\$32.00	1.6	\$410	\$6.50	\$52	\$69.70	\$558
17	BUILDING 7844		Ē	80	\$12.00	\$96	\$32.00	1.6	\$410	\$6.50	\$52	\$69.70	\$558
18	BUILDING 7846		EA	∞ .	\$12.00	96\$	\$32.00	1.6	\$410	\$6.50	\$52	\$69.70	\$558
13	BUILDING 7850		EA	8	\$12.00	96\$	\$32.00	1.6	\$410	\$6.50	\$52	\$69.70	\$558
20	BUILDING 7856		EA	9	\$12.00	\$72	\$32.00	1.6	\$307	\$6.50	\$39	\$69.70	\$418
21	BUILDING 7858		EA	3	\$12.00	\$36	\$32.00	1.6	\$154	\$6.50	\$20	\$69.70	\$209
22	BUILDING 7865		EA	5	\$12.00	09\$	\$32.00	1.6	\$256	\$6.50	\$33	\$69.70	\$349
23													
24	MOBILIZATION COSTS		EA	-	\$200.00	\$200	\$40.00	20.0	\$800	\$0.00	0\$	\$1,000.00	\$1,000
22													
5 6	TOTAL THIS PAGE					\$1,496			\$6,330		\$702		\$8.528
PREPARED BY		APPROVED BY				TITLE OR ORGANIZATION	VION			DATE			
	AJN		DE:				E M C Engineers, Inc.	rs, Inc.				12/13/95	

	ENGINEER'S OPINION OF PROBABLE COST	ON OF PROBABI	8 	ST					SHEET	σ		je.	ę
AREA		ACTIVITY				LOCATION				AMENDMENT NO			2
				3		Ft. Riley, Kansas							
PROJ	PROJECT TITLE						CONTRACT NO.						
EEAP,	EEAP, Feasibility Study for Installation of UMCS	JMCS								DACA01-94-D-0033	0033		
					MATERIAL COST	L COST		LABOR COST		EQUIPME	EQUIPMENT COST	TOTAL COST	COST
:			Cuit	Š				Manhrs					
E.	Item Description	ition	jo	o	Chit		Unit	ber		Guit		Cuit	
Š.			Meas.	Units	Cost	Total	Cost	Piit.	Total	Cost	Total	Cost	Total
-	ALTERNATIVE NO. 1												
2	RADIO FREQUENCY SYSTEM FOR REMOTE SITE MONITORING	FOR REMOTE SITE MON	ITORING										
က	CAMP FUNSTON												
4	BUILDING 1470		EA	-	\$4,635.00	\$4,635	\$22.00	79	\$1.737	\$0.00	S	\$6.372.00	¢6 377
2	GAS METER NO. 3		EA	-	\$5,085.00	\$5,085	\$22.00	79	\$1,737		Ş	\$6,872.00	46,972
9	GAS METER NO. 4		Æ	-	\$5,085.00	\$5,085	\$22.00	62	\$1 737	000	3	\$6.000 OO	40,022
7									5	000	9	90,022.00	770'0¢
∞	CAMP FORSYTH												
6	ANZIO ELECTRIC SUBSTATION		EA	-	\$5,085.00	\$5,085	\$22.00	62	\$1 737	000	9	\$C 822 00	0000
10	GAS METER NO. 5		EA	-	\$5,085.00	\$5,085	\$22.00	62	\$1 737	00.00	2 5	\$0,022.00	\$5,022
1	GAS METER NO. 11 (Colyer Apts.)	(6)	E	-	\$5.085.00	\$5.085	\$22.00	70	64 737	00.00	2	\$0,022.00	\$0,04
12							AFE:00	2	101,10	00.0¢	0	\$6,822.00	\$6,822
13	CUSTER HILL												
14	GAS METER NO. 9		E	-	\$5,085.00	\$5,085	\$22.00	62	\$1 737	00 08	Ş	00 000	40.000
15										00.00	3	\$0,022.00	770'0¢
16	CENTRAL STATION												
17	RF SYSTEM CONNECTION		EA	-	\$1,355.00	\$1,355	\$22.00	44	\$960	\$0.00	Ş	¢2 345 00	\$2 24E
\$											3	42,515.00	616,24
<u></u>													
20													
21													
22													
23													
24													
52													
56	TOTAL THIS PAGE					\$36,500			\$13,119		0\$		\$49,619
PREPARED BY		APPROVED BY			-	TITLE OR ORGANIZATION	ATION			DATE			
	AJN		DEJ				E M C Engineers, Inc.	rs, Inc.			12	12/13/95	

	ENGINEER'S OPINION OF PROBABLE COST	ON OF PROBABI	LE CO	ST				0,	SHEET	\$		OF.	10
AREA		ACTIVITY				LOCATION				AMENDMENT NO.	NO.		
						Ft. Riley, Kansas							
PROJE	PROJECT TITLE						CONTRACT NO.						
EEAP, I	EEAP, Feasibility Study for Installation of UMCS	fUMCS								DACA01-94-D-0033	0033		
					MATERIAL COST	L COST	٦	LABOR COST		EQUIPMENT COST	NT COST	TOTAL COST	COST
			Unit	ģ				Manhrs					
Line	Item Description	ription	ō :	ō	Cait	:	Chit	je j	;	, cuit	;	Cuit	
Š			Meas.	Chits	Cost	lotal	Cost	Cuit	lotal	Cost	Iotal	Cost	lotal
-	ALTERNATIVE NO. 1												
2	FO DTM AND UMCS EQUIP FOR GAS METER MONITORING	OR GAS METER MONITO	RING										
က	MAIN POST AREA - FO DTM												
4	GAS METER NO. 1		5	200	\$2.44	\$487	\$22.00	0.09	\$383	\$0.00	\$	\$4.35	\$870
2	GAS METER NO. 2		4	200	\$2.44	\$487	\$22.00	60:0	\$383	\$0.00	\$0	\$4.35	\$870
9	GAS METER NO. 6		4	150	\$2.29	\$343	\$22.00	20.0	\$3,300	\$0.00	\$	\$3.83	\$3,643
7	GAS METER NO. 8		<u>"</u>	30	\$2.88	\$86	\$22.00	60.0	\$660	\$0.00	0\$	\$4.79	\$746
∞	GAS METER NO. 10		<u>"</u>	20	\$2.88	\$144	\$22.00	60.0	\$1,100	\$0.00	\$0	\$4.79	\$1,244
6	GAS METER NO. 12		5	20	\$2.88	\$144	\$22.00	0.09	\$1,100	\$0.00	\$0	\$4.79	\$1,244
10													
=	MAIN POST AREA - UMCS EQUIPMENT (ACUs and Connection to Utility)	QUIPMENT (ACUS and Co	nnection t	o Utility)									
12	GAS METER NO. 1		EA	0.5	\$1,250.00	\$625	\$22.00	23	\$250	\$0.00	\$0	\$1,750.00	\$875
13	GAS METER NO. 2		EA	0.5	\$1,250.00	\$625	\$22.00	23	\$250		\$0	\$1,750.00	\$875
14	GAS METER NO. 6		EA	1.0	\$1,250.00	\$1,250	\$22.00	23	\$200	\$0.00	\$0	\$1,750.00	\$1,750
15	GAS METER NO. 8		EA	1.0	\$1,250.00	\$1,250	\$22.00	23	\$200	\$0.00	\$0	\$1,750.00	\$1,750
16	GAS METER NO. 10		EA	1.0	\$1,250.00	\$1,250	\$22.00	23	\$200	\$0.00	%	\$1,750.00	\$1,750
17	GAS METER NO. 12		EA	1.0	\$1,250.00	\$1,250	\$22.00	23	\$200	\$0.00	\$0	\$1,750.00	\$1,750
18													
19													
20													
21													
22													
23													
24													
22													
26	TOTAL THIS PAGE					\$7,942			\$9,426		\$0		\$17,368
PREPARED BY		APPROVED BY				TITLE OR ORGANIZATION	ZATION			DATE			
	AJN		DET				EMCEngineers, Inc.	ers, Inc.				12/13/95	